September 10, 2009

Cape Fear River Use Designation Modification from Class C to WS-IV

Background:

- North Carolina Division of Water Quality submitted a request for approval for a use classification revision for a portion of the Cape Fear River from Class C to Water Supply IV.
- Request originated with Lower Cape Fear Water & Sewer Authority (LCFW&SA).
- New intake will initially be used by Smithfield Packing Company as their potable water supply. Projected initial intake of 4MGD.
- The intake will also be used, "in the future" by several municipalities to supply drinking water.
- The proposal met all of DWQ criteria, including testing of the water quality which met current water supply criteria for WS-IV. There is no current WQS for PFOA.
- NC Public Water Supply Section stated that PFOA sampling data provided by DWQ and the LCFW&SA showed "no significant increase in PFOA" due to the discharge from Dupont. Also states that Dupont is on a voluntary schedule to reduce PFOA from emissions and product content by 95% no later than 2010 and eliminate it by 2015. (attached)
- Final recommendation to allow the intake and reclassification included the statement, "the Hearing Officer has considered…the opinion of NCDHE PWS Section staff that the subject waters can be used as drinking water supply once treated.." which gives us the opening to consider that.
- The effective date was January 1, 2009.
- From the web: Bladen Bluffs Regional Surface Water System is proposed for construction with a request for bid which ended 9/1/09.

Additional information:

- OW Provisional Health Advisory: 0.4ppb
- *Perfluorinated Compounds in the Cape Fear Drainage Basin in North Carolina* (Nakayama, et al. 2007)
    - 26 sites had PFOA above 40 ng/L.
    - "…findings indicate the potential for exposures above this threshold if PFOA is not effectively removed by drinking water treatment plants using the Cape Fear River…as source water. The removal of all PFC's by water treatment processes should be evaluated."
- Lee's site visit and information on Dupont Fayetteville.
- Dupont DMR data (attached)

EPA Response:

- EPA must approve/disapprove the new WQS (DU) within 150 days of receipt (approximately by the end of the calendar year.)
    - Include a recommendation for monitoring and treatment of PFOA?
    - Separately address effectively treatment technologies at new SWTP?

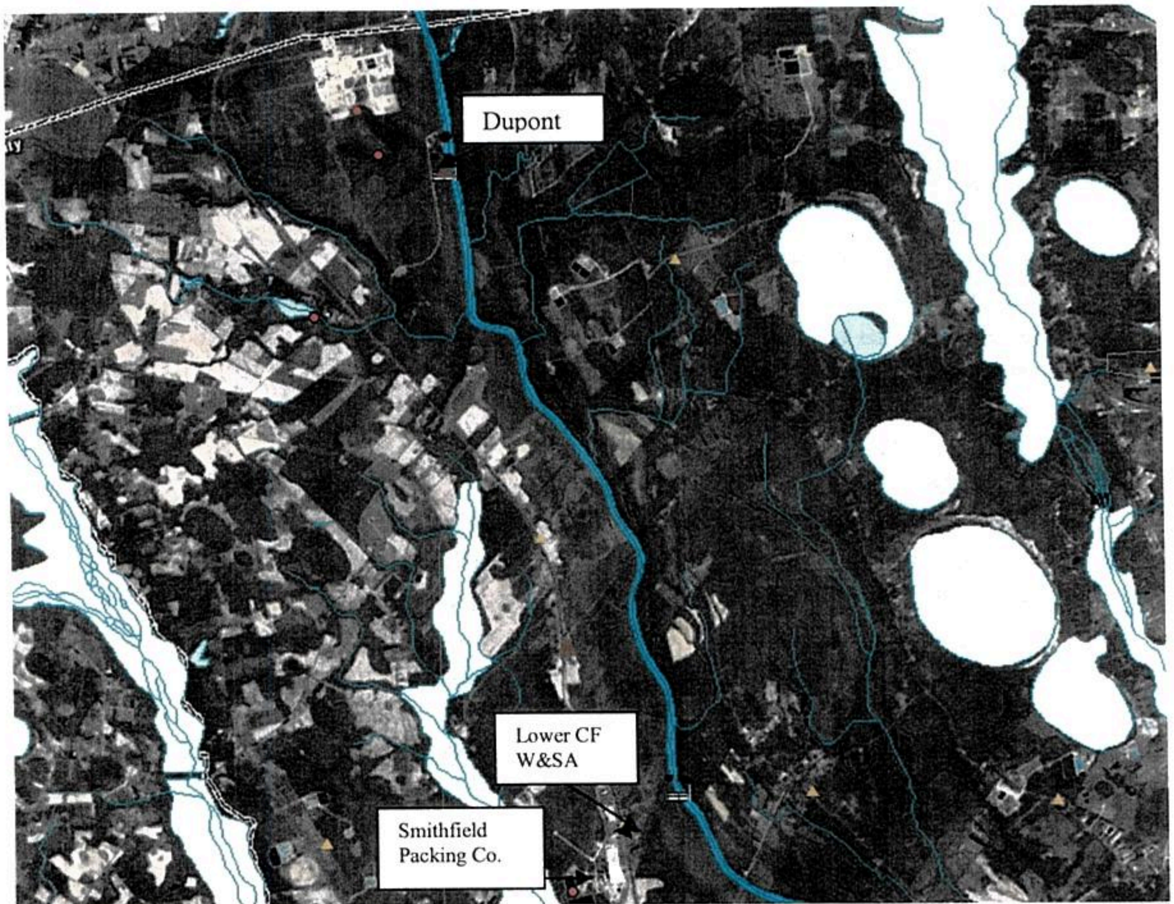

Figure 1: Cape Fear River in Bladen County, North Carolina and Dupont DMR data below:

Jan 2008	ug/l	0.14
Feb 2008	ug/l	0.15
Mar 2008	ug/l	0.1
Apr 2008	ug/l	0.14
May 2008	ug/l	0.12
Jun 2008	ug/l	0.11
Jul 2008	ug/l	0.2
Aug 2008	ug/l	0.097
Sept2008	ug/l	0.02
Oct 2008	ug/l	0.13
Nov 2008	ug/l	0.06
Dec 2008	ug/l	0.04
Jan 2009	ug/l	0.05
Feb 2009	ug/l	0.03
Mar 2009	ug/l	0.019
Apr 2009	ug/l	0.04
May 2009	ug/l	0.22
Jun 2009	ug/l	0.08
July 2009	ug/l	0.05

North Carolina
Division of
Environmental Health

Division of Environmental Health
Terry L. Pierce, Director

Public Water Supply Section
Jessica G. Miles, Section Chief

State of North Carolina
Michael F. Easley, Governor

Department of Environment and Natural Resources
William G. Ross, Secretary

NC0003573

February 8, 2008

Elizabeth Kountis
Classification and Standards Unit
Division of Water Quality-Planning Section

RE: Application to Request Reclassification of a Portion of the Cape Fear River

Dear Ms. Kountis:

The Public Water Supply Section has reviewed the application to request reclassification of a portion of the Cape Fear River which was submitted by Hobbs, Upchurch & Associates on behalf of the Lower Cape Fear Water and Sewer Authority and based on field investigation and review of sampling data finds no reason to object to this reclassification.

The only issue of concern raised during this investigation was the level of an unregulated but potentially emerging contaminant, perfluorooctanoic acid (PFOA or C-8), in the Cape Fear River at the outfall location of the permitted discharge by Dupont approximately five miles upstream of the proposed intake. Sampling data provided by DWQ and the Lower Cape Fear Water & Sewer Authority indicates that there is no significant increase in PFOA caused by this discharge. Current levels of PFOA are below any known health based site specific or ground water proposed standard. Furthermore, it is noted that PFOA monitoring is now a condition of the NPDES permit for the Dupont facility. In the event that PFOA is ultimately regulated, this monitoring data will be important to DWQ in modifying the discharge permit. In addition, as a part of the PFOA Stewardship Program with EPA, Dupont is on a voluntary schedule to reduce PFOA from emissions and product content by 95 percent no later than 2010, and to work toward eliminating PFOA from emissions and product content by 2015. Therefore, we can only conclude that the PFOA should not prevent the reclassification of this stream.

Please feel free to contact Debra Benoy at 910-796-7441 or me at 919-715-3232 if you have questions.

Sincerely,

Jessica G. Miles

Jessica G. Miles. P.E., CPM

cc: Debra Benoy
Wayne Munden

as well as PFBS were found at sampling point 1 in Figure 1. Peak levels of PFOS and PFHS were found in the Little River at sampling point 11. The highest levels of the C6 and C7 acids were found in a small tributary of the Cape Fear River at sampling point 5. These data indicate the presence of many different PFC sources within the Basin. Further evaluation of these areas could be undertaken to identify the various sources.

Comparison to Other Findings. In general, these results are similar to PFOS and PFOA levels measured in 9 major freshwater lakes and rivers throughout New York State (*18*). In that study, median PFOS levels were all below 7 ng/L except Lake Onondaga (a listed Superfund site) where it was found to be 756 ng/L. Median PFOA levels ranged from 14 to 49 ng/L with a high value of 173 ng/L. In the Cape Fear River Basin, median PFOS was 28.9 ng/L with a maximum of 132 ng/L, and median PFOA was 12.6 ng/L with a maximum of 287 ng/L. One difference noted between these two studies is that the New York State effort measured only PFOS, PFOA, and PFHS with a 4 target compound method. In the Cape Fear Basin, all 10 of the target compounds were routinely quantified, with an average of 6 compounds being above LOQ at each location.

Another study examined the impact of a fluorochemical production facility on the Tennessee River in Alabama (*19*). In that study, PFOS and PFOA levels remained below 55 and 25 ng/L, respectively, before the discharge site of the fluorochemical plant. After a 10 km mixing distance downstream of the discharge, the PFOS and PFOA concentrations remained fairly constant, averaging 114 ng/L and 394 ng/L, respectively, for the remaining 55 km of the river that was studied. The authors pointed out that this pattern was consistent with a single source that influenced the main body of the river for a considerable distance after the input. In contrast, the current study revealed evidence of many unidentified sources of PFCs in the Cape Fear Basin leading to much greater overall variability in water concentrations (Figures 2 and S2).

Comparing these results with a nationwide survey in Japan (*20*, *21*), the PFOS and PFOA levels from the present study were at least 3.5−6 times higher than all of the Japanese regions surveyed except the heavily industrialized area around Osaka, where the peak levels of PFOS were found to be 526 ng/L and PFOA was as high as 67 000 ng/L. The authors determined that the PFOA source was a water reclamation facility which receives waste from a number of industrial facilities operating in the area. The elevated PFOS concentrations were found in a tributary draining the Osaka International Airport with the concentrations as high as 526 ng/L (roughly 500 times higher than typical background concentrations in that study). The authors noted that use of fire-fighting foams at airports has been known to cause PFC contamination of ground and surface waters (*22*, *23*) and they speculate that this may be the source of contamination here as well. In light of these findings, it is interesting to note that the highest PFOS concentration measured in the current study (132 ng/L) was from the Little River which runs along the northern boundary of Fort Bragg and Pope Air Force Base (Figure 1). The highest PFHS concentration (26.4 ng/L) was also recorded at this location. In Figure 1 both compounds increase to their maximum concentration as the Little River flows along the northern boundary of this military reservation and it makes its confluence with the Cape Fear River. According to the NC Department of Environment (*24*), the Base is permitted to pump 30 300 kL of wastewater per day into the Little River in this area. This finding is consistent with past or current use of PFOS-containing materials in this area.

Another recent study measured PFCs in the Rhine River and some of its tributaries in Germany (*25*). In general, the median levels of PFOA and PFOS on the Cape Fear were higher than most of the sampling locations on the main body of the Rhine River. One exceptionally contaminated tributary to the Rhine was identified in an area that had received surface application of organic wastes containing PFC material. Further testing of finished drinking water supplies coming from this highly contaminated area showed little evidence of effective removal of the PFCs by conventional activated carbon filters. Like the Japanese work discussed above, this study underscores the worldwide nature of this issue, and it also shows how the systematic application of an effective collection and analysis method can be used to trace and identify PFC sources within a watershed.

Exposure Aspects. A U.S. EPA Great Lakes Initiative methodology (*26*) was used to estimate an avian wildlife value for PFOS of approximately 43 ng/L (*17*). PFOS concentrations below this level are estimated to be protective of trophic level IV bird species which consume aquatic organisms at equilibrium with PFOS in the water. Because of uncertainties in the estimate, the authors (*17*) consider this value to be "probably overly conservative, possibly by 50−100 fold." It is interesting to note that 17 (22%) of the sampling sites in this study had PFOS concentrations above this 43 ng/L threshold (Figure 2B). The New York State study (*18*) and a recent Korean study (*27*) also found limited areas where this threshold was exceeded.

While this study only measured *surface water*, a health-based guidance level recommended by the State of New Jersey for PFOA in *drinking water* provides a reference point for interpretation of some of the data from the current study. The State of New Jersey Department of Environmental Protection has recommended that PFOA levels in *drinking water* not exceed 40 ng/L in order to be protective of both non-cancer effects and cancer at the one in one million risk level (*15*). In the current study, 26 sites (32%) had PFOA levels above 40 ng/L. While no drinking water measurements were made in this study, these findings indicate the potential for exposures above this threshold if PFOA is not effectively removed by drinking water treatment plants using the Cape Fear River and its tributaries as source water. The removal of all the PFCs by water treatment processes should be evaluated.

In conclusion, this method for 10 target PFCs in surface water specifically identifies the key performance characteristics (accuracy, precision, and sensitivity) that are needed to design and conduct sampling surveys which will adequately document surface water quality. This pilot study of the Cape Fear Drainage Basin found ample evidence of potential sources of PFCs, with PFOS and PFOA being the most prevalent compounds identified. The C7, C9, and C10 acids and PFHS were also commonly detected, suggesting other sources of these materials as well. In general, the indication of a wide variety of PFC sources indicates that much further work will be required to evaluate this river system and the potential impacts on drinking water sources, wildlife species, and potential human exposures. This study contributes to the growing body of data that suggests that PFC contamination in the waterways of the industrialized world is pervasive and as yet poorly characterized.

Acknowledgments

We thank Waters Corporation for their contribution through Cooperative Research and Development Agreement (CRADA #392-06) and Wako Pure Chemical Industries, Ltd. for their contribution through the CRADA (#399-06). We also thank the following individuals for contributing to this work: Dr. Laurence Libelo, USEPA; Professor Akio Koizumi, Kyoto University, Japan; Dr. Norimitsu Saito, the Research Institute for Environmental Sciences and Public Health of Iwate Prefecture, Japan; and Dr. Jerry Varns, USEPA. This research